

Paper

Outcome Following Proximal Femoral Fracture in Northern Ireland

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ABSTRACT

Objective: To study the outcome following treatment for proximal femoral fracture in elderly people.

Methods: All consecutive males and females admitted to the acute fracture service at the Royal Victoria Hospital and the Belfast City Hospital for the 3 years from 1999 to 2001 were studied. The data was collected by trained research nurses. Variables gathered included age, sex, marital status, mental state, pre-injury Barthel score and the American Society of Anaesthesiology (ASA) physical status grading. The information was gathered on admission to hospital and at four, six and 12 months after the injury.

Results: The total number of patients studied between January 1999 to December 2001 was 2834 of whom 77% were female and 23% were male. The mean (median) length of stay in the acute fracture service was 10.7 (9 days). The mean (median) length of stay in the rehabilitation ward was 35.3 (24 days). The 30-day mortality was 6.9%, the four-month mortality 15.6 % and one year mortality 22.3 %. Of those subjects living at home at the time of fracture 68% remained at home at one year. Factors predicting successful return home were higher mental test score, younger age, female sex, higher Barthel score, better pre-injury mobility and better ASA score.

Of those able to walk independently outdoors before injury 40% regained this ability by 12 months. Factors predicting return of pre-injury mobility were poorer pre-injury mobility, younger age, higher mental test score, better ASA category, higher Barthel score, and previous residence at home.

The proportion admitted from their own home and discharged by 56 days was 56%.

Conclusion: The standardised measurement of outcome in hip fracture subjects enables comparison between units and facilitates improvement in standards of care available to the increasing number of elderly patients presenting with proximal femoral fracture.

INTRODUCTION

Alongside the need to identify correctable causes for proximal femoral fracture, particularly the role of reduced bone mass, bone quality and prevention of falls, it is essential that the present care of patients presenting to hospital is appropriate and effective. Deficiencies in care have been highlighted in a number of reports.^{1,2}

Proximal femoral fracture is a common condition in elderly people with 80% occurring in females. It affects 12% of women and 5% of men by the age of 85 years and carries a high morbidity and mortality.^{1,3} The incidence of fracture of the proximal femur is increasing more rapidly than would be expected as a result solely of the projected increase in the elderly population.³⁻⁷ Together these and other factors result in proximal femoral fracture occupying 25% of orthopaedic beds,¹ with the attendant hospital costs further increased by subsequent community care.

The number of proximal femoral fractures in Northern Ireland between 1985 and 1997 increased faster than that anticipated

due to demographic changes alone, and there is predicted to be a doubling in the number of fractures between 1997 and 2016.⁸ As the unit cost of hip fracture is estimated to exceed £12,000,⁹ there is a clear need to ensure appropriate use of resources in management of proximal femoral fracture. In addition to hip fracture, other fractures including Colles' fracture, vertebral fracture, humeral fracture and pelvic fracture commonly occur as a consequence of osteoporosis, resulting in a cumulative 1 in 3 lifetime risk of an adult woman having an osteoporotic fracture. The prevalence in males is also substantial with a 1 in 12 lifetime risk of suffering an osteoporotic fracture.¹⁰ The increasing recognition of the need for collaboration between orthopaedic surgeons and

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physicians in geriatric medicine¹¹ has led to the development of either liaison services or orthopaedic geriatric units of varying designs.¹²⁻¹⁸ Other innovations have included a rapid transit system¹⁹ or use of a hospital at home nursing service.²⁰ Considerable differences in mortality after proximal femoral fracture have been highlighted.²¹⁻²³ Increasing attention is being paid to the need to measure and study the factors which effect outcome following hip fracture and in turn enable comparison between different services.²⁴⁻²⁶

There are as yet no universally agreed clinically relevant and acceptable indicators of outcome.^{27,28} The Department of Health has suggested two clinical indicators namely discharge home within 56 days of admission and 30-day mortality. The National Service Framework for Older People,²⁹ stated as part of standard 6, that operations for fracture repair should be carried out within 24 hours of admission by experienced staff.

This study commenced in November 1997 in both the Royal Victoria Hospital and Belfast City Hospital. In November 1999 the fracture services amalgamated on the Royal Victoria Hospital site.

METHODS

All consecutive males and females with fracture of the proximal femur admitted to the acute fracture service at the Royal Victoria Hospital and Belfast City Hospital for 3 years from January 1999 to December 2001 were studied.

The clinical service is provided for a population of ~ 800,000 people from across Northern Ireland. A range of socio-demographic and medical information was collected by trained audit research nurses on admission and by telephone at four, six and 12 months after injury. The main variables used in this study are age, sex, marital status, an abbreviated mini mental state score on admission,³⁰ pre-injury Barthel activities of daily living score (0-20)³¹ and the American Society of Anaesthesiology physical status grading (category 1 least impaired to category 5 most impaired and not expected to survive 24 hours).³²

The principal outcome measures gathered were death, mobility, Barthel score and domicile.

RESULTS

The total number of patients admitted between January 1999 and December 2001 was 2834, of whom 2171 (77%) were female (mean age 79.9, range 18-103 years) and 663 (23%) were male (mean age 73.0, range 15-98 years).

Length of Stay

The mean (median) length of stay in the acute fracture service was 10.7 (9 days). The mean length of stay in the rehabilitation ward of the 1128 subjects transferred was 35.5 (24 days). The overall mean number of days of total hospital care was 37.8 (27 days).

Mental Score

The overall mean (median) mental score on admission was 6.6 (8) with females having a mean score of 6.5 (8) and males 7.1 (9). The proportion of patients alive at one year for each mental score value is shown (*fig 1*).

Barthel Score

The mean (median) Barthel score on admission in females was 14.6 (16) falling to 12.5 (13) at four months, then rising to 12.8 (14) at six months and 13.3 (15) at 12 months. For males the admission score was 15 (17) falling to 13.6 (14) at four months, then rising to 14 (16) at six months and 14.4 (17) at 12 months (*fig 2*).

Locomotor Disability

The proportion of patients able to walk independently outdoors pre-injury was 45% (42% in females, 55% in males), falling to 24% of those alive at six months and 28% at 12 months. 40% of those able to walk independently outdoors pre-injury (36% in females, 50% in males) regained this ability by 12 months.

Table I gives the results of multiple logistic regression analysis in order to determine the factors which predict a return to pre-injury walking ability. This indicates that there is strong evidence that patients with a worse pre-injury walking ability were more likely to regain their pre-injury score, with those who walked with company indoors or who were chair bound or bedridden being seven times more likely to regain their pre-injury status than those who previously walked alone outdoors (OR 6.9, P value <0.001). Subjects who walked with company outdoors or alone indoors were three times more likely to regain their pre-injury status than those who previously walked alone outdoors (OR 3.3, P value <0.001). Further predictors of a return to pre-injury walking ability were younger age, higher mental test score, having an ASA score of 1, 2 or 3, a higher Barthel score (all P value <0.001), and living at home, (P value <0.03). The receiver operating characteristic (ROC) area under the curve was 72%.

Multiple logistic regression analysis of the factors predicting a return to pre-injury mobility in only those initially residing at home resulted in similar findings.

ASA Score

The mean (median) ASA score in females pre-operatively was 2.77 (3) and in males was 2.73 (3). The distribution of scores is outlined in Table II. The mortality at 12 months grouped by ASA score is illustrated (*Fig 3*) indicating a mortality of 5% in ASA group 1, 12% in ASA group 2, 22% in ASA group 3, 39% in ASA group 4 and 78% in ASA group 5.

Mortality

The 30-day mortality was 6.9% (5.7% for females and 10.9% for males). The mortality at 4-months was 15.6% (13.8% for females and 21.5% for males), at 6 months was 17.6% (15.6% for females and 24.2% for males) and at 1 year was 22.3% (20.3% for females and 28.8% for males).

Surgical Management

A total of 15.6% of subjects underwent surgery in less than 24 hours following admission, 24.4% between 24 and 48 hours, with the remaining 60% greater than 24 hours. The mean (median) time to operation was 3.4 days (2.7). There were 111 patients (3.9%) who were managed conservatively without surgery.

Domicile

The majority of subjects (72%) resided at home at the time of fracture, with 3.1% in residential care and 21.7% in nursing home care. Of the 2034 subjects living at home at the time of fracture 68% remained at home at four months. After one year 68% were living at home, 20% had died, 10% were in nursing home care and 1% in residential care. Of the 613 admitted from nursing home care 43.5% (42% in females, 58% in males) had died at one year, 52% returned to nursing home care and 3% had returned home.

The proportion admitted from their own home and discharged home by 56 days was 56%.

Table III shows the results of multiple variable logistic regression analysis to determine the factors predicting a return to home for those subjects originally residing at home. They indicate that there is strong evidence that patients are more likely to return home if they have higher mental test scores, are younger, are female, or have higher Barthel scores (all $P < 0.001$). There is also evidence to suggest that patients who are in ASA categories 1, 2 or 3 are more likely to return home than those in categories 4 or 5, and that patients with a better pre-injury locomotor ability are more likely to return home (both $P = 0.03$). The receiver operating characteristic (ROC) area under the curve was 77%.

DISCUSSION

This study has allowed us to identify more clearly outcomes of hip fracture patients within Northern Ireland and enable comparison with other units or communities. Factors influencing recovery of pre-injury mobility in hip fracture patients included pre-injury mobility, age, mental state, ASA score, Barthel score and domicile. Similarly the factors influencing return home included mental state, age, sex, Barthel score and pre-injury mobility. The Department of Health has suggested measuring the proportion discharged home within 56 days (56% in this study) and 30 day mortality (6.7% in this study) as clinical indicators but uncertainty remains as to whether these are the most useful or relevant measures.

The **mortality** in this study for males (28.8%) and females (20.3%) at one year may be compared with those reported from the Oxford region³³ from 1984-1998 of 41% for males and 38.4% for females. The mortality in Scotland³⁴ at 120 days is 27% for males and 21% for females, in comparison to 24% for males and 16.9% for females in Northern Ireland.

The **mental state** influences outcome and those with a normal mental score (AMT 10/10) had a one year mortality of 9.3% in comparison to 11.7% reported from Stuttgart.³⁵ Those subjects with a mental score of less than 5 have a one year mortality in excess of 30%.

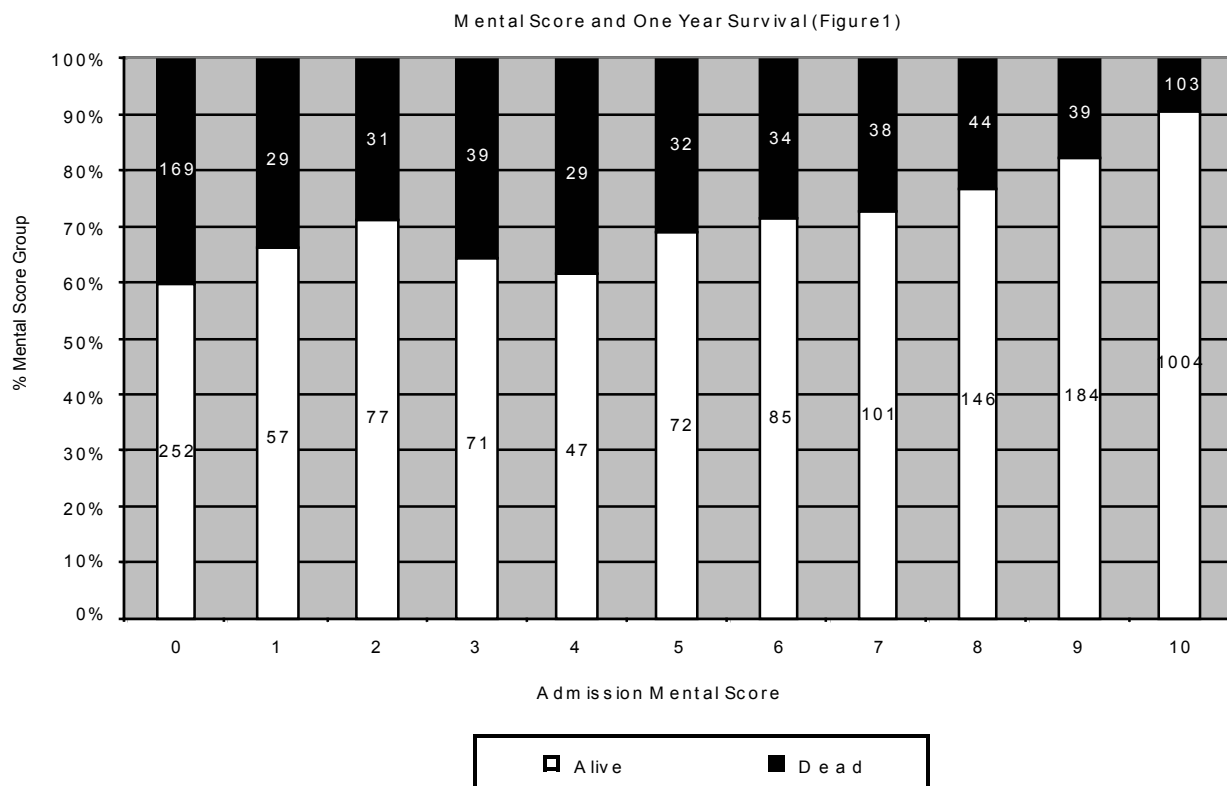


Fig.1 Mental Score and One Year Survival

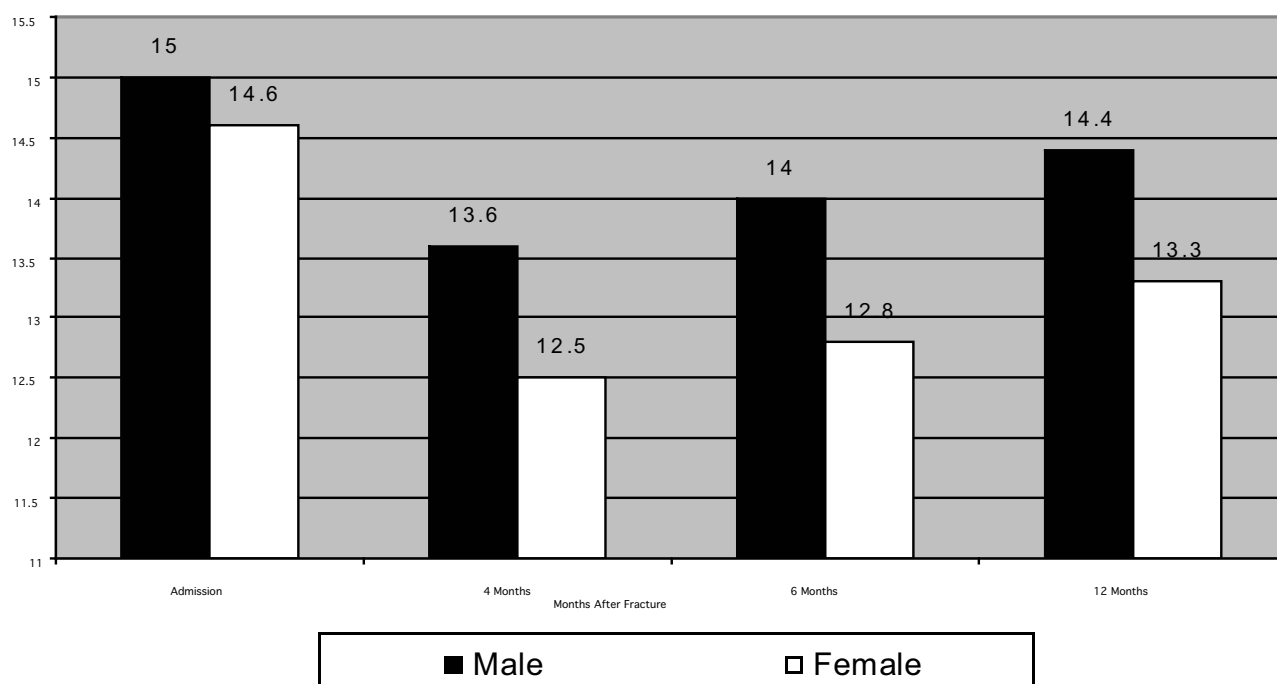


Fig 2. Average Barthel Score on Admission, 4, 6 and 12 months after Fracture.

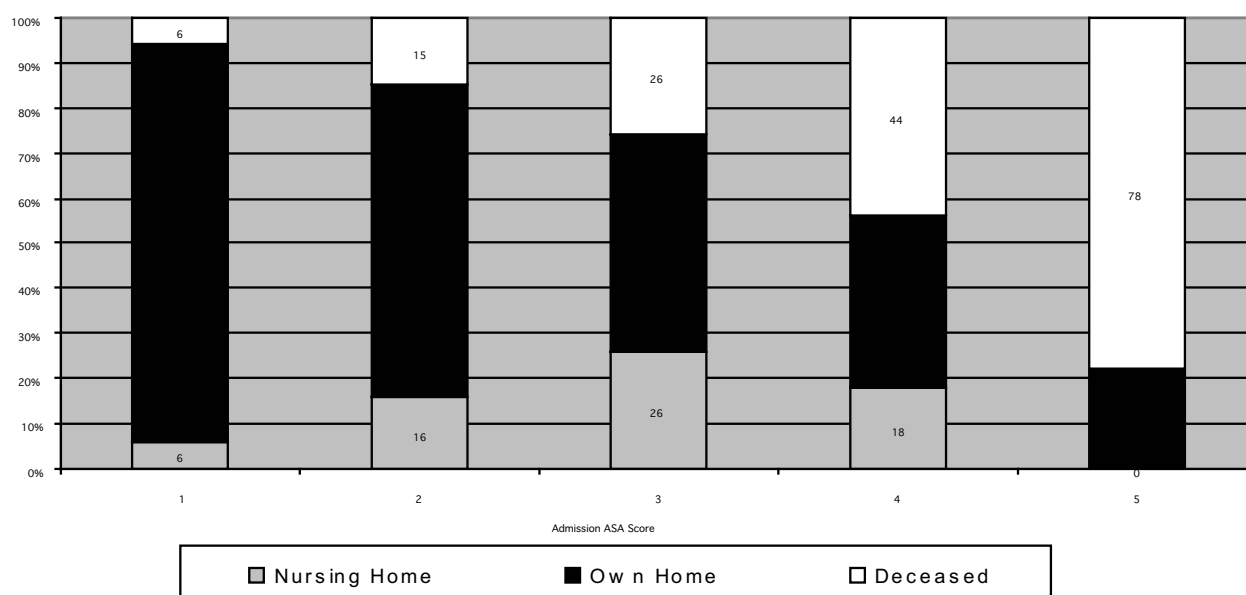


Fig 3. 12 month outcome grouped by ASA Score on admission.

Domicile is also related to outcome. Of those subjects admitted from home, for our patient group 16.8% were dead at one year in comparison to 22% in Peterborough.³⁶ This may be compared to the mortality rate of 17.4% recorded in community dwelling subjects aged 65 years and over in Baltimore, USA.³⁷

Subjects admitted from **nursing home care** had an increased mortality at one year of 52% in males and 36% in females compared to those in Geneva, Switzerland, of 61% in males and 30% in females.³⁸ Interpretation of this finding may be difficult due to differences in levels of dependency and prevalence of dementia for nursing home residents in different health care systems. Of those admitted from home, by 4 months 67% had returned home, which is similar to the outcome in Scotland³⁴ of 68%. Interestingly 72% were admitted from home which is markedly higher than the 60% reported in Scotland. Of those admitted from home 11% were in institutional care after one year.

Mobility is an important indicator of outcome. Of those independently mobile prior to fracture, 40% regained independent mobility by one year, in comparison to 24.4% independent in walking and stair climbing in New York³⁹ after six months.

The **mean length of total hospital stay** of 38 days is comparable to the mean of 32 days in Scotland,³⁴ but remains significantly longer than the mean stay of 22 days recorded in Peterborough.⁴⁰ This figure is influenced by other aspects of care as regions may differ in the use and availability of nursing home and intermediate care facilities for on-going treatment which would not be included as hospital care.

The **ASA Score** is also an important indicator of outcome with subjects with an ASA score of 1 and 2 had a 1 year mortality of 11% as compared to those with a score of 3 and 4 whose mortality was 24%. An outcome table has been produced for males and females separately by age group (<65, 65-74, 75-84, 85+ years) and using the ASA gradings. This provides information regarding 12 month survival, which is currently used to assist in ward based discussions with patients and relatives regarding outcome. While caution is necessary in applying this population derived information to individual

patients, it does provide one measure of absolute risk.

The increased risk of death after hip fracture is associated with, age, male sex, poorly controlled systemic disease, psychiatric illness and institutionalisation.^{41,42} These and other factors undoubtedly contribute through case-mix variations to the spread of outcomes such as the 90-day mortality rate variation of between five and 24% reported from East Anglia.²¹ However, other correctable factors are likely to be contributing to improved outcome and may be amenable to change producing beneficial improvements for patients care. The standardised measurement of outcome should therefore enable comparison between units and facilitate improvements in standards of care for the increasing number of elderly patients presenting with proximal femoral fracture. This approach is currently being employed in the development of a national hip fracture registry in the United Kingdom to which Northern Ireland is contributing.

Our study has allowed us to measure outcome in a number of ways with particular emphasis on the factors influencing return to previous domicile and return to pre-injury mobility, but it has to be borne in mind that additional factors such as availability of community care schemes to support discharge home were not included in the factors analysed. We have previously highlighted the factors predicting survival and the effects of delays to surgery.⁴³

We advocate the ongoing collection of mortality figures at 30 days, four months and one year and the collection of information regarding domicile, functional ability and mobility at the same time points. If a common data set is collected including information on other aspects of care, case-mix adjusted differences between units, regions or countries can be examined for the influence of either external factors (eg greater numbers of nursing home residents, increased ASA scores reflecting case-mix) or differences in the provision of care (eg time to theatre, presence of orthogeriatric care). This approach will provide a more meaningful assessment of the quality of care provided to patients who have suffered a fractured neck of femur than is possible by measuring discharge home within 56 days or 30 days mortality alone.

The authors have no conflict of interest.

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TABLE II

ASA Score on Admission (n=2834) and 12-month Mortality

ASA Score	Number	Percentage	12-month Mortality (%)
1	123	4.7%	4.9%
2	650	24.8%	11.8%
3	1582	60.5%	21.9%
4	253	9.7%	39.1%
5	9	0.3%	78%
Total	2617	100%	20.5%

TABLE I

Multivariable logistic regression model for factors predicting a return to pre-injury locomotor ability

	Odds ratio	Confidence intervals	Wald	P-Value
Age (per year)	0.95	0.94-0.96	104.65	<0.001
Locomotor ability				
(WCO/WAI) versus (WAO)	3.31	2.62-4.19	99.104	<0.001
(WIC/CHR/BED) versus (WAO)	6.93	4.78-10.05	104.33	<0.001
Mental score (0-10)	1.12	1.08-1.16	35.81	<0.001
ASA (1,2,3) versus (4,5)	2.32	1.68-3.20	26.18	<0.001
Barthel (0-20)	1.06	1.03-1.09	15.84	<0.001
Domicile (home versus other)	1.33	1.02-1.74	4.47	0.03

Abbreviation: WAO, walks alone outdoors
WCO, walks with company outdoors
WAI, walks alone indoors

WIC, walks with company indoors
CHR, chair bound
BED, bed ridden

TABLE III

Multivariable logistic regression model for factors predicting a return to home

	Odds ratio	Confidence intervals	Wald	P-Value
Mental score (0-10)	1.19	1.14-1.25	60.09	<0.001
Age (per year)	0.95	0.94-0.97	44.78	<0.001
Sex (male versus female)	0.43	0.32-0.56	35.14	<0.001
Barthel (0-20)	1.07	1.03-1.11	12.64	<0.001
ASA (1,2,3) versus (4,5)	1.54	1.06-2.25	5.03	0.03
Locomotor ability				
(WCO/WAI) versus (WAO)	0.70	0.53-0.91	6.90	<0.01
(WIC/CHR/BED) versus (WAO)	0.71	0.43-1.17	1.78	0.18

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